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Implementation of a Strategic Reserve in Belgium: Product Design and Market Results

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SUMMARY

In order to mitigate the risk of inadequate electricity supply during the winter period, the Belgian authority has introduced a capacity mechanism in the form of a strategic reserve. The main objective of this mechanism was to contract retired and mothballed generation capacity, complemented with demand response, in order to ensure the availability of sufficient capacity to meet the peak demand. The goal of the paper is to present and discuss the implementation of the mechanism, product design choices, and the market outcome for the first three winter periods 2014/15, 2015/16 and 2016/17 after the introduction of the capacity mechanism.

The development of the strategic reserve is driven by concerns towards generation adequacy in the Belgian control zone, which originated following the nuclear phase-out decision, the low profitability of the gas-fired generating units, and the absence of investments in generation capacity.

The strategic reserve is operational during the winter period lasting from 1st November to 31st March. A yearly recurring process is initiated which starts more than one year in advance of the winter period with an analysis conducted by the system operator regarding the security of supply, and the additional capacity requirements to meet the predefined reliability criteria. Within two months after the study, a Ministerial Decree is issued that decides upon the volume to be procured. In parallel, during a stakeholder process involving all market participants the procedure for the constitution of the strategic reserve and the functioning rules are defined by Elia. During the tendering process, the candidates for the strategic reserve in the following winter period are selected, based on techno-economic analysis.

The participation at the strategic reserve is allocated to two categories, namely the Strategic Generation Reserve and Strategic Demand Reserve. Generation and demand response located in the Belgian control zone can be contracted for a period of 1 to 3 years, upon decision if the federal administration. In the first two winter periods, 2014/15 and 2015/16, there was a strong increase of the targeted volume from 1 200 MW to 3 500 MW, respectively. However, in both periods the targeted volume could not be fully contracted due to absent offers, and final contracted volumes were 847 MW respectively 1 536 MW. These capacities include respectively 96 and 358.4 MW of demand response. For 2016/17, no additional volume is targeted, and the contracted volume will be kept at 750 MW.

The strategic reserve in the winter period is activated by means of an economic and a technical trigger. The economic trigger is linked to insufficient supply to meet the demand in the day-ahead market. The technical trigger is linked to the risk of structural shortage within the control zone.

The reported costs have been transferred into an additional network tariff following a public service obligation, of respectively 0.611 €/MWh and 0.997 €/MWh for every MWh consumed as from respectively February 2015 and January 2016.

KEYWORDS

Capacity mechanism, Generation adequacy, Experience report, Market functioning, Strategic reserve

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1 INTRODUCTION

Capacity mechanisms are implemented as a policy instrument for ensuring an adequate level of electricity generation [1]. A capacity mechanism is a mechanism to value capacity contributing to adequacy, i.e. generating units or demand response capacity, generally leading to a revenue stream for the capacity owners, in addition to the energy-only market [2]. While the objective is similar for all capacity mechanisms, different generic capacity mechanism designs exist[1], of which one type of implementation is the strategic reserve. The Belgian strategic reserve implementation follows these main characteristics of a strategic reserve. Generally, speaking, a strategic reserve mechanism is implemented alongside an energy-only market. It establishes an out-of-the market, i.e. back-up, generating capacity that can be activated by the system operator if there is scarcity, i.e. insufficient capacity to meet the demand. This contracted capacity is not allowed to operate in energy or ancillary service markets, and is only activated upon a trigger, either economic or technical [2].

Figure 1 shows the involved market participants and their relationship in a conceptual scheme. The authority determines in consultation with the system operator and / or the regulator on a target volume for the strategic reserve. Afterwards, the system operator is authorized to contract this capacity from capacity providers, e.g. generating units or demand response. The system operator is also responsible for the certification of the contracted capacity. Once contracted, the decision on the activation of capacity is with the system operator. The activation is intended to ensure generation adequacy during hours of system stress. Finally, the costs for contracting and activation are allocated to the final consumers, usually in form of a "use of system" charge.

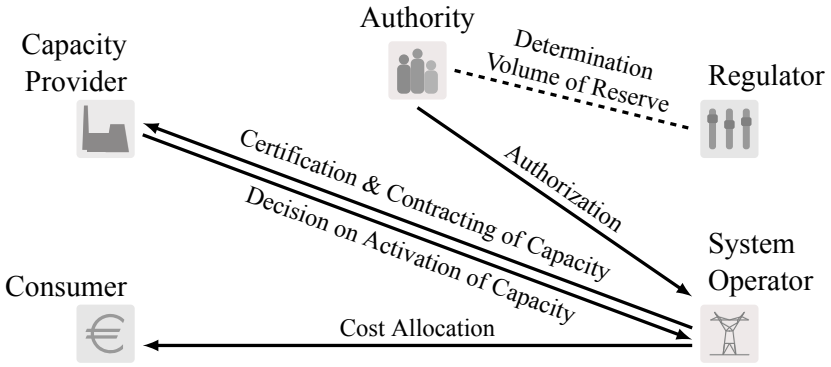

Figure 1: Market participant and their roles in a strategic reserve design

In what follows, Section 2 introduces the context that lead to the development of the Belgian strategic reserve mechanism and outlines the yearly recurring procurement process. Section 3 describes the product design choices with respect to the contracting and the activation of the strategic reserve. Market results of the winter periods 2014/15, 2015/16 and 2016/17 are discussed in Section 4 and the conclusions of the paper are given in Section 5.

2 IMPLEMENTATION OF A STRATEGIC RESERVE IN BELGIUM

In order to avoid scarcity, i.e. insufficient capacity to meet the demand, and to avoid interruptions in the electricity supply, the Belgian authority has decided to introduce a strategic reserve as from the winter period 2014/15. The implementation of the Belgian strategic reserve was brought forward for the first time by the Plan Wathelet in June 2012 [3], as a larger plan to ensure the Belgian security of supply. The plan got accepted by the government in July 2013 and put into law in March 2014 [4] which initiated the legal and practical implementation process.

[1] A detailed description on the different types of implementation can be found in the technical brochure of the Cigré Working Group C5.17 [2]. Described types are *Strategic Reserve, Ex Ante Capacity Obligation, Ex Post Capacity Obligation, Capacity Auction, Reliability Options, Capacity Payment,* and *Capacity Subscription*.

2.1 PROBLEM SETTING

The reason for the implementation of a Belgian strategic reserve is driven by adequacy concerns in the Belgian control zone. The concerns originate from multiple developments. Firstly, the concern needs to be viewed in the light of the stepwise nuclear phase-out scheduling the closure of the first nuclear power plants starting in 2015/16 [5]. This first step would close down 1.8 GW of the generation capacity while facing peak demand of about 12-13 GW [6][2]. Additionally, unplanned outages of the nuclear units due to technical issues have lead to concerns about the availability of the ageing units [8]. Secondly, the increase share of injection from Renewable Energy Sources (RES) has increased the needs for flexibility in the system over the last year. A significant increase of installed capacities based on wind power (1.9 GW_p in 2014 [6]) and PV (2.9 GW_p 2014 [6]), resulting in approximately 12 % of generated electricity in Belgium in 2014, is expected to lower wholesale market prices. Finally, the announced closure of existing gas-fired power plants due to the ageing of the units, or non-profitability, decreased the available capacity with 928 MW in 2014 [9].

Together, these developments have lead to a discussion towards generation adequacy of the Belgium power system. Next to flexibility issues of the generation mix, the upward adequacy especially in winter months has been of concern. A set of measurements has been proposed by the Secretary of State of Energy[3] [3]. The measures include among others the revision of the nuclear phase-out schedule, i.e. the lifetime extension of nuclear units by 10 years (put in law in 2015 [7]), and the implementation of a strategic reserve to keep power plants, announced to be closed, available during winter months (put in law in 2014 [4]).

2.2 YEARLY PROCUREMENT PROCESS

The strategic reserve in Belgium is implemented by means of Art. 7 of the law on the organization of the electricity market [4]. It imposes an annual process of procurement (Figure 2) and the responsibilities of the actors. Although the strategic reserve is operational during the winter period, as from 1st of November until 31st of March of the following year, the strategic reserve capacity is contracted for one to three years.

The starting point is an analysis regarding the security of supply, conducted by the system operator. The analysis determines the required volume of capacity to reach the reliability criteria which are put forward by the law, i.e. the Loss of Load Expectation (LOLE), under different scenarios and sensitivities. The scenarios include the expected closures of generating units which have to be announced by the 31st July in the year before the actual closure (Art. 4 of [4]). The final analysis is due prior to the 15th November one year before the start of the winter period. Based on the study, and after advice on the necessity and volume by the Federal Public Service (FPS), the Federal Minister of Energy instructs the system operator to constitute the strategic reserve for the upcoming one to three winter periods by Ministerial Decree. This happens within one month after the advice given by the FPS, so the latest in mid-January. After that, the system operator determines the tendering rules via the Procedure for Constitution of Strategic Reserve [10] after consulting the market actors, CREG and the Federal Public Service. Afterwards, the procedure is initiated the latest 1 month after the Ministerial Decree.

After the tendering process, the system operator reports the received offers to the regulator CREG. All generating units that announced closure in the previous year are obliged to submit an offer in the tendering process. The regulator controls the received offers and gives advice whether the prices for the related volumes submitted by the suppliers are considered reasonable. In case of a positive advice the capacity can be contracted, otherwise prices and volumes can be imposed by Royal Decree, after a proposal by the minister. The CREG finally approves the functioning rules [11] of the strategic reserve, determining the operation of the strategic reserve in the electricity market.

[2] In June 2015, by change of law, the lifetime extension is granted to the nuclear power plants scheduled to close in 2015 and 2016. Consequently, the beginning of the nuclear phase-out was shifted to 2022. The current schedule foresees the closure of all nuclear power plants between October 2022 and December 2025 [7].

[3] In Belgium, the role of Minister of Energy can be replaced by a Secretary of State. The Secretary of State of Energy acts as the Minister of Energy but has no right to vote in the cabinet.

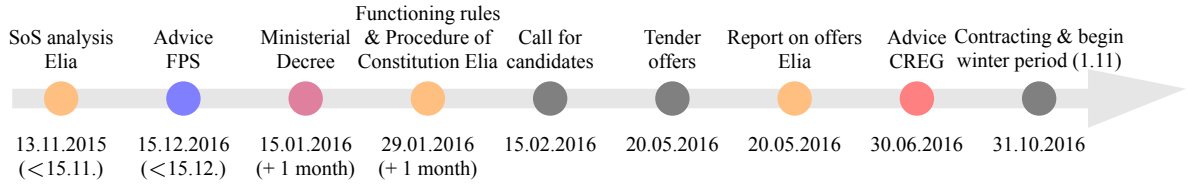

Figure 2: Time line for the contracting of strategic reserve Winter 2016/17 (based on [4, 12])

3 DESIGN OF STRATEGIC RESERVE

As seen in the previous section, the implementation process is started with more than one year lead time due to the winter period initialized by the security of supply assessment. The following section highlights the most important aspects from the constitution procedure [10] and the functioning rules [11]. Distinction is made between the contracting before the winter period, and the possible activation during the winter periods.

3.1 CONTRACTING OF STRATEGIC RESERVE

The contracting of the strategic reserve is split into two categories, namely the Strategic Generation Reserve (SGR) and Strategic Demand Reserve (SDR). In the following sections highlights the most important facts for the contracting. The technical and contractual details for the contracting are documented in the functioning rules [11]. The described characteristics follow the functioning rules and constitution procedure for the winter period 2015/16. The selection of the bids is determined by the law [4] and based on a techno-economic assessment taking into account the submitted bid characteristics.

3.1.1 Strategic Generation Reserve (SGR)

Candidates for being contracted as SGR are only generating units within the Belgian control zone, i.e. cross-border capacity is not allowed to participate. All generating units announcing the closure of the unit are obliged to submit an offer to the strategic reserve. The generating units must be able to deliver the service during the 5 winter months and are obliged to remain out of the market for 12 months starting 1st of November. The contract duration can cover up to 3 winter periods. For the first Strategic Reserve 2014/15, contracts with duration of 12 months to 36 months were targeted. This has been adapted for the second strategic reserve 2015/16 to either 12 months or 24 months. The generating units are invited to submit bids for both time horizons in parallel. The minimum volume for the participation is 1 MW. If selected the SGR receives a monthly payment during the 5 winter months according to its bid price based on the contracted capacity over the given time period [€/MW-h].

The number of activations for the winter 2015/16 is limited to 131 with a maximum activation time of 699 hours. These numbers are based on simulations following the adequacy study by Elia. This contracted volume adds to the 750 MW already contracted SGR from the winter period 2014/15 with contract duration of 3 years (see also Fig. 5). Additional limits for the contracted volume may apply. The contracted volume from SGR for the winter period 2015/16 is limited at 500 MW. A minimum capacity of 300 MW is contracted if sufficient offers are available. In contrast, no limitation on the contracted SGR has been applied in the first winter period.

The bid for the SGR must include both economic and technical parameters on which the selection process is based. The economic parameters include the reservation price (€/MW/h) and the fixed activation cost (€/Notification). Technical parameters include next to offered capacity information on the fuel type and fuel consumption which is taken as baseline for the calculation of the activation and delivery cost using average prices for the respective fuel. The offers can be kept confidential on request of the offering party as the bid contains sensitive data on the cost structure.

3.1.2 Strategic Demand Reserve (SDR)

The candidates for SDR must be located within the Belgian control zone. The candidates for SDR can chose among four different options. The options differ in their definition of the capacity and parameters for the activation. Two main distinctions can be made between *drop to* and *drop by*. In case of *drop to*, the offered capacity is the commitment of the supplier to reduce its demand to a predefined capacity. It is determined by a lower shedding limit representing a minimum consumption of the SDR supplier. In case of *drop by*, the offered capacity represents a fixed bandwidth. The supplier reduces its demand by a predefined capacity. The reduction is compared with the promised reference capacity. The *drop by* contract also includes an unshedable margin during activation, i.e. a minimum consumption which cannot be exceeded downwards. This is to avoid a unintended increase of consumption by the SDR provider in order to ensure the contracted volume. Consequently, for both cases, the full capacity is not guaranteed during activation. The level of capacity that can be offered is certified taking into account the historical consumption profiles.

Within the two categories, each two sub products with different parameters exist. The two sub products exist with both a maximum length of activation and minimum time between activation of 4 hours respectively 12 hours. Moreover, they vary in the amount of activation per winter period, namely 40 respectively 20 activations per winter period. All products are based on contract duration of 12 months.

Also the bid for the SDR must include both economic and technical parameters on which the selection process is based. The economic parameters include the reservation price (€/MW/h) and the fixed activation cost (€/Notification). Next to that, the variable cost for activation (€/MWh) and cost for prolongation (€/h) must be stated explicitly.

During the contracting and the techno-economic assessment of capacity from SDR, an equivalence factor is applied to SDR. The equivalence factor is a de-rating of the capacity depending on the total contracted volume from demand response. To do so, all offers are ordered based on the bids. For the first 300 MW, an equivalence factor of 1 is applied. Afterwards, the equivalence factor is stepwise reduced for each every additional 300 MW up to 0.196. This is done to account for the limited amount of activation per SDR unit and to ensure that enough capacity is available in case of many activation per winter periods.

3.2 ACTIVATION OF STRATEGIC RESERVE

The activation of the strategic reserve has two important characteristics. These are *(i)* the triggers starting the activation process and *(ii)* the possible impact on the imbalance market price during activation. Note that the activation of the strategic reserve is only possible during the winter periods between 1st of November and 31st of March.

3.2.1 Detection: triggers of activation

Two different triggers for the activation of the strategic reserve are defined, namely an economic and a technical trigger. Only these triggers can initiate the notification of the contracted capacities leading to generation by power plants respectively the reduction of demand.

Economic trigger The economic trigger is linked to the market outcome of the Belgian day-ahead market *Belpex DAM*. In case there is not sufficient supply to satisfy all demand, and the price reaches the cap of 3 000 €/MWh, the volumes of the strategic generation reserve are bid ex post in a separate Belpex Strategic Reserve Market Segment *Belpex SRM* at the price cap 3 000 €/MWh [13]. This mechanism does not generate spill overs to other countries, respects the merit order, and avoids market distortions.

Technical trigger The technical trigger is activated by the system operator Elia if it detects a sufficient risk for a structural shortage in the Belgian control zone. This follow up is done using forecasts on estimated consumption and generation and is conducted intra-day, after clearing of the day-ahead market (18h00). The structural shortage is detected if the forecast demand for the Belgian control

zone is higher than the forecast generation plus the available incremental bids (IBIDs)[4] or there is an insufficient margin to cover an unplanned outage of a nuclear unit.

3.2.2 Process of activation

The process of activation of the strategic reserve includes four consecutive steps, namely detection, notification, verification and delivery. This is visualized in Figure 3. The detection step is described in the previous section. The other steps follow a logical consequence. The timing and the associated parameters X, Y, Z are part of the offers of the individual capacity providers. The maximum values are predetermined in the function rules and are chosen that the contracted capacity have the capabilities to satisfy the needs. The maximum time between notification and delivery, i.e. the minimum requirements for flexibility, are 5 hours for both SGR and SDR. After the notification, the contracted capacities can start with preparing the generation respectively the load reduction. During the verification, the final decision on the delivery is taken. The delivery follows afterwards for a maximum duration of Z hours.

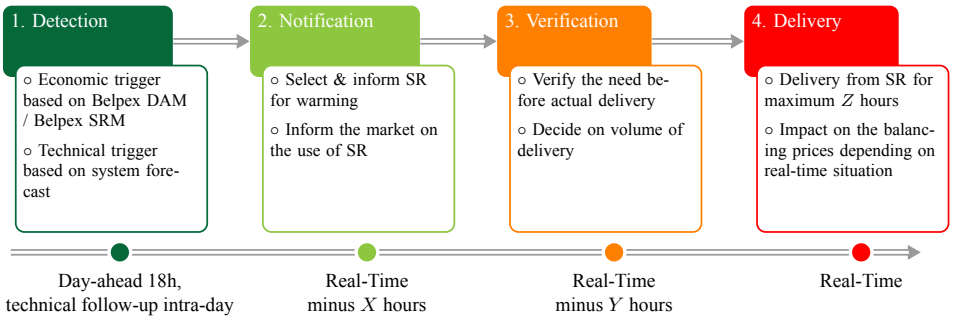

Figure 3: Four phases of activation process (based on [14])

3.2.3 Adaptation of imbalance price during delivery

The injection from strategic reserve also influences the price in the real-time market, i.e. the imbalance tariff. If there is an activation following an economic or technical trigger, there are two possibilities of adaptation to the price. This process is illustrated in Figure 4.

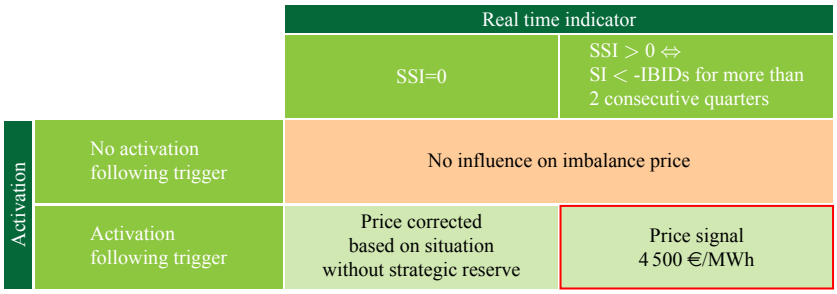

Figure 4: Impact of strategic reserve on Imbalance Price (based on [14])

Firstly, in order to prevent enduring situations in which market participants individually are not providing enough capacity to balance their own portfolios, adaptations to the imbalance price are introduced. The purpose of the adaptation is to give maximal incentives for market participants to maintain their portfolio balance in case of structural shortage, and avoid that market participants would transfer their shortage from day-ahead to the real-time. Therefore, when the strategic reserve is activated upon one of the triggers, an administrative price is set of 4 500 €/MWh. The increase of the price signal is done

[4] Incremental bids (IBIDs) are free reserve capacity bids. The unused capacity after the day-ahead market is transferred to the balancing market.

depending if the real-time structural shortage indicator (SSI) is positive. The SSI is considered positive if in consecutive quarters the system imbalance (SI) cannot be covered by the incremental bids (IBIDs) (bottom right of Figure 4). The incremental bids include the increase of the output by a generating unit on behalf of the system operator in real-time up to its maximum output. Otherwise, if the SSI is not positive, the imbalance price is the price that would have occurred without the delivery from the strategic reserve (bottom left of Figure 4).

4 MARKET OUTCOME

After the legal decision on the implementation of a strategic reserve in 2014, the two consecutive winter periods 2014/15 and 2015/16 have past. Furthermore, the expected volume for the winter 2016/17 is known. The following section outlines the market outcome of these first market periods.

4.1 WINTER 2014/15, 2015/16 AND 2015/2016

4.1.1 Contracting and Activation

The targeted capacity volume for the strategic reserve has been changed with each winter period. In the first winter, the target was at 1 200 MW. Towards the winter 2015/16 the volume was increased to 3 500 MW. For the upcoming winter 2016/17, the targeted volume has been reduced to zero (Figure 5). The strong increase in the winter 2015/16 was motivated by the absence of nuclear units due to the nuclear phase-out and the announced closure of more gas-fired units. For the winter periods 2014/15 and 2015/16, the total offered capacity was not sufficient to cover the targeted volume up to the full demand. The contracted capacity in 2014/15 was only 850 MW of the targeted 1 200 MW. The offered capacity in the second winter period has only been 805 MW while the additionally required capacity was 2 750 MW. For the upcoming winter, the targeted capacity is already fulfilled by the contracts of the first winter contracted with contract duration of 3 years (see Figure 5). Next to the absolute volume, there have been additional targets on the shares from SGR and SDR. In 2014/15, the minimum share of SDR has been set to 50 MW. In 2015/16, the additionally contracted volume from SGR was limited in the range of 300 to 500 MW, implying that the remaining capacity originating from SDR. The actually contracted volumes in 2014/15 consisted of 750 MW SGR and 96 MW SDR. While SDR was contracted for 12 months, the SGR of the period 2014/15 have been contracted for 3 years until the winter 2016/17 (see Figure 5). In 2015/16, the persistent SGR of the winter 2014/15 could be extended with 427.1 MW SGR and 358.4 MW SDR, both, on basis of yearly contracts. No additional contracting for the winter 2016/17 is necessary on top of the SGR contracted in 2014/15. Especially, the fluctuation of the share coming from SDR is noticeable. It increased from 96 MW in the first winter to 358.4 MW in the second winter. There is no contracting planned for the winter 2016/17. Except for test activations initiated by the market participants and/or the system operator, so far, there has been no activation of the strategic reserve either based on an economic or a technical trigger in the winter periods 2014/15 and 2015/16. The test activations have solemnly the purpose to verify the availability and reaction time of the contracted capacity and their limited influence the market impact during activation is corrected as good as possible by the system operator.

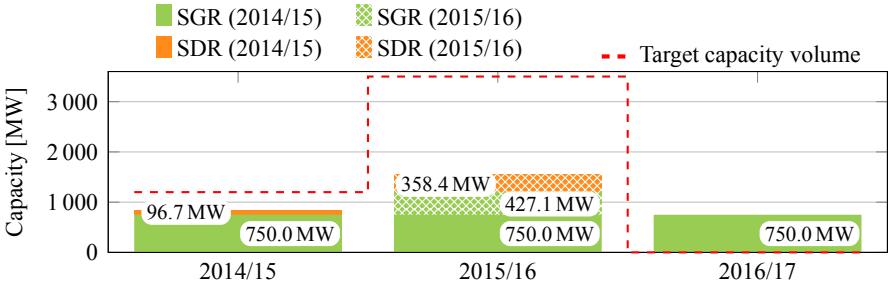

Figure 5: Development of sizing and contracting volumes

During the process of contracting of the winter 2014/15, one offer was considered unreasonable. Following the advice of the regulator CREG, the submitted volume and proposed price in the offer was adapted by Royal Decree before the contracting [15].

4.1.2 Cost and Inclusion in Network Tariffs

As the accepted bids including the prices for reservation and activation are not made public, only the costs brought to account by Elia give insights on the costs for the strategic reserve. The system operator is obliged to submit the costs and proposed tariff for refunding to the regulator. In turn, the regulator approves the proposed costs and tariff structure [16]. The communicated costs for the first winter period 2014/15 and the months November and December of 2015 sum up to 42.79 M€. The costs include the cost for reservation of 36.86 M€ (on average 43.4 k€/MW and year) and the transaction cost of 5.938 M€ for Elia. Additional costs for the activation are not reported.

In order to refund the costs, Elia is permitted to charge an additional network tariff covering public service obligations of 0.611 €/MWh for all consumers. The tariff became effective by the 1st of February 2015. Assuming an annual electricity consumption of approximately 80 TWh in Belgium, the tariff sums up to 48.88 M€. As of January 2016, the tariff is increased to 0.972 €/MWh.

4.2 DEVELOPMENT OF STRATEGIC RESERVE

The first winter periods and the implementation of the strategic reserve have shown that the strategic reserve has fulfilled its initial purpose, namely ensuring the generation adequacy despite the announced closures and the temporarily unavailability of the nuclear power plants. For this purpose the strategic reserve has been implemented being a basic and effective short-term solution to keep generating units, which announced to close, available outside of the market. At least 750 MW from generating units have been kept available and new sources of demand response on transmission and distribution level have been exploited. Notwithstanding that the targeted capacity has not been fully contracted for both winter periods 2014/15 and 2015/16.

One challenge of the strategic reserve is the determination of the volume more than 12 months in advance. Given the long span between assessment and delivery, the assessment of the security of supply can only give recommendations for different scenarios. Based on the scenarios, one volume has to be selected. For the winter period 2015/16, the initial forecast required a volume of 3 500 MW. Closer to the winter period, the actual required volume has been reduced due to for example the development of flexibility of demand leading to an estimated reduction of the peak demand with 600 MW.

With the lifetime extension for the nuclear power plants by 10 years, the necessity of the strategic reserve can be discussed, at least for the purpose of ensuring the upward adequacy in coming winter months. After the decision on the lifetime extension, several concerns on the profitability of other conventional power plants have been raised. There is a threat of the strategic reserve to become a subsidy scheme for existing gas-fired power plants creating a slippery slope. In the long term, the strategic reserve does not facilitate the construction of new capacity. This capacity is however needed to deal with adequacy before and after the phase out of the nuclear units, and provide the required flexibility to deal with RES.

Over the periods of the 3 years, the Belgian strategic reserve has been developed into a mature product that allows the participation of generating units and demand response within the Belgian control zone. Especially for demand response, the product has helped the demand side management sector developing to an advanced state. Nevertheless, additional effort is necessary to standardize the product with respect to benchmarking and verification of demand response, metering of demand response on transmission and distribution level, and the transfer of energy during activation.

The current implementation of the strategic reserve achieved the initial goals. However, it is to be seen how the strategic reserve or, more general, a capacity mechanism accompanying the Belgian energy-based market will evolve in the upcoming years. With respect to the Guidelines on State aid by the European Commission [17], a design also needs to be market-wide and technology neutral as well as needs to address cross-border participation. This has not been part of the Belgian design so far. Changing

purposes, changing needs of flexibility and compliance with the Guidelines on State Aid are likely to require a redesign of the Belgian capacity mechanism in the long term.

5 CONCLUSIONS

In order to avoid scarcity, and ensure security of supply during winter months, the Belgian authority has decided to introduce a strategic reserve. The strategic reserve is a form of capacity mechanism which aims to overcome threats to the generation adequacy, in particular to cover the demand peaks during the winter. It gives additional incentives for gas-fired power plants, announced to be closed during reviewed winter periods, in order to remain available for system stress situation. In addition, demand response on transmission and distribution level is exploited to react on insufficient supply.

The Belgian mechanism follows the general concept of a strategic reserve. Emergency capacity is contracted by the system operator, operated by the capacity owner, but activated by the system operator upon predefined triggers indicating system stress situations. This mechanism explicitly targets generation capacity which is out-of-the-market, i.e. it does not participate in energy or ancillary service markets. An economic trigger is linked to insufficient supply on the day-ahead market. The technical is linked to a risk of structural shortage identified by the system operator by means of assessing expected production schedules, demand and reserve margins. The product design, the procurement process, and functioning rules are well documented, and published by the system operator, following the yearly tendering process.

The market outcome of the first two winter periods 2014/15 and 2015/16 reveals that the targeted volume could never be contracted to its full extent due to absent offers. Yet, during the winter months, an activation of the strategic reserve has not been necessary because neither the economic nor the technical trigger have been triggered. In fact, the threat of a partial brown-out and the related debate on generation adequacy put large attention to the topic of adequacy. The strategic reserve ensured the availability of gas-fired power plants and new demand response sources have been exploited. In total, the contracted volume of the strategic reserve has increased from 850 MW to 1 535 MW. Hereby, the volume of demand response could be increased from 96 MW in the first winter to 427.1 MW in the winter 2015/16. However, the targeted volume fell to zero in 2016/17, and the contracted volume is reduced to 750 MW (three year contract in 2014/15) due to the prolongation of the nuclear fleet.

The cost of for the first winter period 2014/15 plus November and December 2015 is communicated as 42.79 M€. The costs include the cost for the contracting and the transaction cost of the system operator. These costs have been transferred into an additional network tariff of 0.611 €/MWh applicable for all consumers. The tariff became effective February 2015, and is increased to 0.972 €/MWh as from 2016.

The Belgian strategic reserve proofed to be an effective short-term solution for the upward adequacy problem in Belgium. Both, already built capacity have been kept available and new sources of demand response have been exploited. However, a rethinking of a Belgian capacity mechanism is likely to be required. Firstly, strategic reserves do not facilitate investments in new capacity, which is a shortcoming in the context of adequacy and need for flexibility. Secondly, future capacity mechanisms are likely to align in a European policy framework based on cross-border participation and technology neutrality.

APPENDIX: Product information on Belgian Strategic Reserve

This paper provides a summary of all implemented functioning rules and product definitions established during the implementation process. For more information and details on technical specifications, the reader is referred to the published and continuously updated documentation by the system operator:

- Elia: Product Sheet Strategic Reserve (English) [14]
- Elia: Procedure for the Constitution of Strategic Reserve (English) (2015/16) [10]
- Elia: Functioning Rules of the Strategic Reserve (Dutch/French) (2015/16) [11]

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